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ABSTRACT

Results of the Survey of Enrollments and Degrees for physics and astronomy programs are presented. The changing numbers of institutions (doctoral, master's, and bachelor's) during 1977-1982 are indicated and institutions are classified by highest physics degree offered. Tables provide the number of physics degrees granted 1970-1981, by the three degree levels; enrollment of juniors and seniors at the undergraduate level, and total graduate and first year physics student enrollments. After declining over the last 9 years, the enrollment of junior physics majors has again reached the 1972-1973 level (over 6,000); and total graduate school enrollment has reached the level it was in 1975-1976 (over 10,000). The enrollments at the introductory physics level continue to exceed a quarter of a million. Enrollment increases occurred in the South (South Atlantic and East South Central), while the Northeast and West coast enrollment declined slightly. Information is also presented on the actual and projected number of undergraduate physics majors by class level for the classes of 1982-1985; undergraduate physics majors and graduate physics degrees by geographic region and type of institution, 1980-1981; trends in entering foreign graduate physics students, 1970-1982; full-time and part-time graduate physics enrollment by type of institution, 1973-1982; unfilled assistantships for first-year graduate physics students in doctorate-granting departments, September 1981; actual and projected number of physics doctorates granted, 1970-1986; number of physics degrees granted by sex and minority group status, 1980-1981; trends in astronomy enrollments and degrees, 1975-1982; and astronomy enrollments 1981-1982 and degrees 1980-1981 by type of institution. (SW)

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AIP Report - Manpower Statistics Division

American Institute of Physics, 335 East 45 Street, New York, NY 10017

ENROLLMENTS AND DEGREES

by Susanne D. Ellis

April 1982

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AIP report MANPOWER STATISTICS DIVISION

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ENROLLMENTS AND DEGREES

by Susanne D. Ellis

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While some concern may be expressed over the gradual decrease in the total number of physics-degree-granting institutions, physics enrollments are increasing at both the graduate and undergraduate levels. This report is based on AIP's longest uninterrupted annual survey, the Survey of Enrollments and Degrees which has the distinction of summarizing the data of nearly 100% of the 793 degree-granting physics and astronomy institutions.

Table I presents the changing numbers of institutions for the past five years and classifies them by highest physics degree offered. Only one institution, the University of New Orleans, dropped its PhD program but continued to maintain its master's program. The net changes in master's- and bachelor's-degree-granting departments resulted both from expansions, (two new master's and two new bachelor's programs), and terminations, (two discontinued master's and nine discontinued bachelor's programs).

Back in 1970 we started to ask department chairmen to distinguish between the two types of master's degrees granted when reporting their degree totals. Thus the graphs presented in **Figure I** include four curves instead of three, which indicate leveling trends for the two types of master's degrees.

TABLE I. Institutions by highest physics degree offered, 1977-82.

Academic year	Doctorate granting	Master's granting	Bachelor's granting
1977-78	172	110	506
1978-79	170*	104	502
1979-80	169*	96	501
1980-81	168*	103	492
1981-82	167**	104	485

** Five of these institutions have two physics doctorate-granting departments; the second one is generally an applied physics department. They are Stanford U., U. of CA-Davis, U. of CA-San Diego, Harvard U., and Cornell U.*

*** Four of these institutions have two physics doctorate-granting departments. They are Stanford U., U. of CA-Davis, Harvard U., and Cornell U.*

Fig. I. Physics degrees awarded by academic year, 1970-81

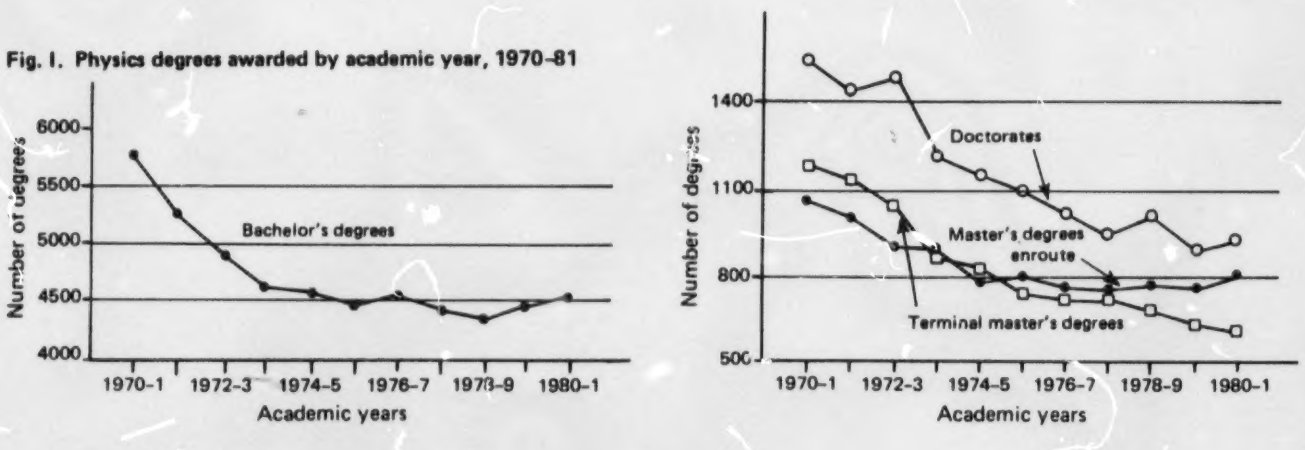

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Table II. Physics enrollments and degrees awarded by academic year 1970–82

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment*	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year
1970–71	5755	2300	1530	6884	6663	14 327	3494
1971–72	5282	2143	1438	6593	6162	13 276	3336
1972–73	4923	1961	1445	6012	5806	11 804	2904
1973–74	4652	1772	1236	5858	5108†	11 119	2680
1974–75	4571	1650	1167	5660	4909†	10 410	2668
1975–76	4487	1570	1111	5888	4922†	10 372	2646
1976–77	4517	1469	1051	5711	4930†	9 991	2624
1977–78	4457	1422	971	5820	4975††	9 835	2499
1978–79	4416	1428	1033	5835	4964	9 813	2458
1979–80	4440	1370	912	5696	4942	9 647	2439
1980–81	4513	1387	927	5905	5091	9 934	2564
1981–82				6386	5372	10 173	2637

* *Includes part-time students.*

† *This total has been adjusted by 500 for students who are seniors for more than one year.*

†† *This total has been adjusted by 300 students who are seniors for more than one year.*

Table III. Undergraduate and graduate enrollments and degrees by institution type, 1970–82

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year
			Doctorate granting institutions				
1970–71	2868	1817	1530	3510	3490	12 400	2658
1971–72	2502	1640	1438	3082	2987	11 434	2449
1972–73	2265	1484	1445	2787	2717	10 227	2177
1973–74	2155	1387	1236	2644	2484	9 759	2169
1974–75	2191	1318	1167	2780	2420	9 295	2205
1975–76	2182	1249	1111	2983	2505	9 241	2163
1976–77	2184	1186	1051	2862	2502	8 867	2182
1977–78	2218	1164	971	2851	2590	8 852	2138
1978–79	2158	1183	1033	2937	2579	8 864	2107
1979–80	2142	1151	912	2696	2491	8 744	2072
1980–81	2123	1161	927	2765	2568	9 062	2223
1981–82				2996	2671	9 273	2275
			Master's granting institutions				
1970–71	1044	483		1220	1175	1927	836
1971–72	982	503		1238	1210	1842	887
1972–73	820	477		1145	1086	1577	727
1973–74	810	385		939	893	1360	511
1974–75	699	332		881	741	1115	463
1975–76	604	321		916	811	1131	483
1976–77	658	283		840	761	1078	442
1977–78	590	258		832	752	983	361
1978–79	541	245		795	694	949	351
1979–80	585	219		705	650	903	367
1980–81	589	226		868	655	872	341
1981–82				917	734	900	362
			Bachelor's granting institutions				
1970–71	1843			2154	1998		
1971–72	1798			2273	1965		
1972–73	1838			2080	2003		
1973–74	1687			2075	1731		
1974–75	1681			1999	1748		
1975–76	1701			1989	1606		
1976–77	1675			2009	1667		
1977–78	1649			2137	1633		
1978–79	1717			2103	1691		
1979–80	1713			2295	1801		
1980–81	1801			2272	1868		
1981–82				2473	1967		

Table IV. Introductory physics enrollments in physics-degree-granting institutions by geographic region 1977–82

Geographic region †	1977–78	1978–79	1979–80	1980–81	1981–82
New England	19 672	19 356	18 797	21 766	20 228
Mid Atlantic	44 839	42 652	41 555	43 216	41 879
E.N. Central	51 598	50 434	50 843	54 663	54 430
W.N. Central	22 253	21 115	21 805	23 406	23 420
S. Atlantic	38 519	33 097	33 966	33 800	36 544
E.S. Central	15 003	14 835	14 829	15 068	16 276
W.S. Central	29 968	26 768	28 563	30 030	28 188
Mountain	20 490	19 342	20 753	21 035	23 408
Pacific	32 635	32 084	31 318	35 150	34 656
Total	274 977	259 683	262 429	279 134	279 029

†New England—*Conn., Me., Mass., N. Hamp., R.I., Vt.;* Middle Atlantic—*N.J., N.Y., Pa.;* East North Central—*Ill., Ind., Mich., Ohio, Wisc.,* West North Central—*Iowa, Kansas, Minn., Mo., Nebr., N. Dak., S. Dak.;* South Atlantic—*Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W. Va.;* East South Central—*Ala., Ky., Miss., Tenn.;* West South Central—*Ark., La., Okla., Tex.;* Mountain—*Ariz., Colo., Idaho., Mont., Nev., N. Mex., Utah, Wyo.;* Pacific—*Alas., Cal., Hawaii, Oreg., Wash.*

Table II offers the numerical data for **Figure I** and also includes undergraduate and graduate enrollment trends. It might be pointed out that juniors and total graduate students reached enrollment levels not attained in nine and six years respectively. Not since 1972–73 was the number of junior physics majors over 6,000; similarly, the total graduate enrollment is once again above 10,000 not having been that large since 1975–76.

A closer examination of the increases in enrollments and degrees reveals how uniformly they are distributed among the three types of institutions. For example, **Table III** shows how the overall 8% increase in juniors between September 1980 and September 1981 is comprised of 8%, 6% and 9% increases at the PhD-master's—and bachelor's-granting institutions respectively. Similarly, the increases in graduate enrollments and degrees were shared by both types of graduate institutions. The exception to these uniformly distributed increases is the number of bachelor's degrees; their net increase of 1.6% is made up of a 1% decrease at the doctorate-granting institutions, offset by increases of 1% and 5% at the master's—and bachelor's-institutions respectively.

The comprehensive summary of enrollments and degrees in the first three tables of this report allows us to focus on a more detailed analysis of the physics pipeline in **Tables IV** through **XI**.

Introductory physics enrollments

The study of physics is not widely incorporated into this country's secondary school curricula, but often begins at the freshman-sophomore level in colleges and universities. Here, science requirements for engineering, physical science or health-related majors frequently serve to introduce students to physics for the first time. **Table IV** shows the enrollments at the introductory level continue to exceed a quarter of a million. Enrollment increases can be observed in the South [South Atlantic and East South Central] while the Northeast and West coast enrollments declined slightly, leaving the net total introductory constant.

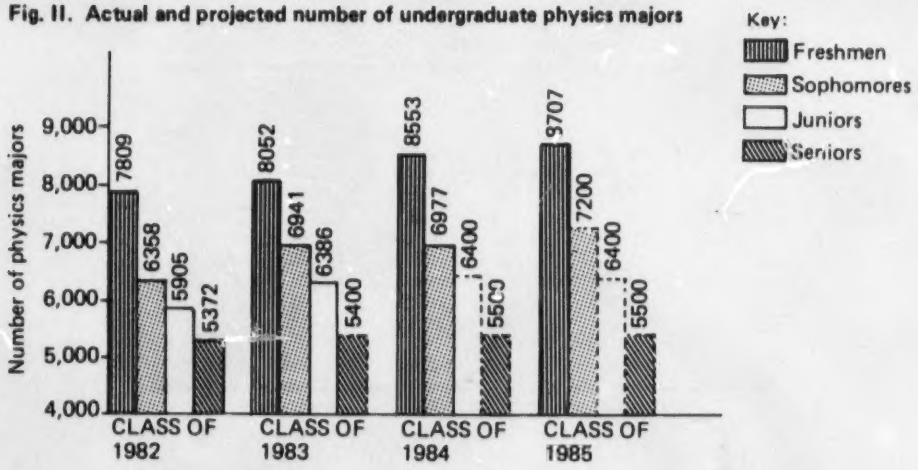
An analysis of these introductory physics enrollments with respect to the design of the course is presented in **Table V** and indicates no significant changes from the previous year.

Table V. Introductory physics enrollments, 1981–82

Enrollment in introductory physics courses designed for:	Institution type* I N	I %	II N	II %	III N	III %	Total N	Total %
engineering majors	19 192	28.2	12 826	30.0	71 774	42.9	103 792	37.2
physical science majors	14 854	21.8	7 786	18.3	25 982	15.4	48 622	17.4
biology, health-related majors	20 026	29.4	11 709	27.5	42 866	25.5	74 601	26.7
others	14 006	20.6	10 305	24.2	27 703	16.5	52 014	18.7
Total introductory enrollment N	68 078		42 626		168 325		279 029	
Total introductory enrollment %	24.4		15.3		60.3			100.0

*"*Institution type" indicates the highest degree offered; type I = bachelor's degree, type II = master' degree, type III = doctorate*

Fig. II. Actual and projected number of undergraduate physics majors



Note: Each cluster of four bars shown in Figure II depict the freshmen, sophomores, juniors, and seniors of four successive graduating classes. The most recent estimate of freshman physics majors is 8707 and refers to September 1981. Based on the attrition of earlier classes 5500 of them are expected to become senior physics majors in 1984–85 and are presented above as the "class of 1985".

Undergraduate physics majors

Using estimates provided by the physics department chairmen of their prospective physics majors, it is possible to compute the attrition rates that occur in four years of undergraduate study. Thus the first set of bars in **Figure II** follows the 1978-79 freshman physics majors through four years of undergraduate study to become the graduating class of 1982. The chairmen's most recent estimates of freshmen, 8707 continue the steady increase observed since the fall of 1978, and support the concept of a renewed interest in the hard sciences.

Table VI presents greater detail on the enrollment of undergraduate physics majors by showing their distribution in nine regions of the U.S. The last column of this table "Fifth-year undergraduates", consists of about 600 students who need an additional summer session or term to complete their degree requirements; in some cases transfers from junior colleges cause such a delay. Thus, by separating those 600 seniors from the others, each physics major at each level is counted only once.

A comparison with earlier years of the enrollments by type of institution, shown in the lower portion of **Table VI**, indicates different attrition rates for the three types of institutions. The 2671 seniors at the PhD-granting institutions represent 78% of the estimated number of freshmen who intended to be physics majors in September 1978. The master's and bachelor's institutions retained only 67% of their respective freshmen classes.

Table VI. Undergraduate physics majors by geographic region and type of institution, 1980-81

Geographic region*	Estimated** no. of freshmen	Estimated** no. of sophomores	Number of juniors	Number of seniors	Fifth-year undergraduates
New England	724	672	598	529	44
Mid Atlantic	1 462	1 170	1 089	803	80
E. N. Central	1 406	1 048	957	783	81
W. N. Central	672	593	516	398	20
S. Atlantic	1 317	1 003	897	730	55
E. S. Central	344	316	327	263	21
W. S. Central	803	650	503	480	101
Mountain	600	436	408	409	52
Pacific	1 379	1 089	1 091	977	148
Total	8 707	6 977	6 386	5 372	602
Doctorate-granting inst.	3 967	3 168	2 996	2 671	300
Master's-granting inst.	1 172	946	917	734	103
Bachelor's-granting inst.	3 568	2 863	2 473	1 967	199

* *See Table IV for explanation of geographic region.*
** *Estimates of potential physics majors made by the physics department chairmen.*

Graduate enrollment

A major factor contributing to the rising graduate physics enrollments is the influx of foreign students. Traditionally physics has always been a discipline which, at the graduate level, attracted a relatively large number of students from abroad. The data in **Table VII** show how that influx accelerated. The jump in foreign students from 32.9% to 37.3% in the most recent year shown in **Table VII** is somewhat more pronounced if one singles out the PhD-granting departments. For that group of institutions, the percentage of first-year graduate students was 34% in 1980–81 and 39% in 1981–82.

Table VII. Trend in entering foreign graduate physics students, 1970–82

Academic year	Foreign students N	Foreign students %	Total first-year students
1970–71	615	17.6	3494
1971–72	606	18.2	3336
1972–73	612	21.0	2904
1973–74	614	22.9	2680
1974–75	594	22.3	2668
1975–76	551	20.8	2646
1976–77	637	24.2	2624
1977–78	648	26.0	2499
1978–79	618	25.2	2458
1979–80	739	30.3	2439
1980–81	844	32.9	2564
1981–82	983	37.3	2637

In addition to citizenship, another noteworthy characteristic of graduate physics students is their study status. At the PhD-granting institutions over 90% of them are enrolled on a full-time basis. On the other hand, part-time graduate students at the master's-granting institutions comprise more than one-third of the enrollment. **Table VIII** presents a nine-year trend of the study status of graduate physics students at both types of institutions.

When for the first time in 1979 we asked chairmen about assistantships for graduate students, we did not realize how important a topic student support would become by 1981-82. The question we asked concerned unfilled assistantships for first-year graduate students. An analysis of the 1981 data shows a marked decline from 64 to 43 departments which report unfilled assistantships. The total number of assistantships declined by one-third and only six departments in the entire country reported more than five unfilled assistantships per department; however, the distribution of all unfilled assistantships varied by geographic region, as shown in **Table IX**. In New England only two departments reported additional assistantships it did not fill. By comparison, one year earlier, that number of departments in New England was eight. Similarly, the 17 departments which reported no unfilled assistantships in that region, represents an increase from 11 departments one year earlier.

Table VIII. Full-time and part-time graduate physics enrollment by type of institution, 1973–82

Academic year	Total number of graduate students, Institution type* II			III			
	Full-time	Part-time	Sub-total	Full-time	Part-time	Sub-total	Total
1973–74	734	626	1360	8810	949	9759	11119
1974–75	623	492	1115	8326	969	9295	10410
1975–76	628	503	1131	8439	802	9241	10372
1976–77	576	507	1083	8119	789	8908	9991
1977–78	546	437	983	8174	678	8852	9835
1978–79	468	481	949	8185	679	8864	9813
1979–80	550	353	903	8059	685	8744	9647
1980–81	484	388	872	8302	760	9062	9934
1981–82	543	357	900	8555	718	9273	10173

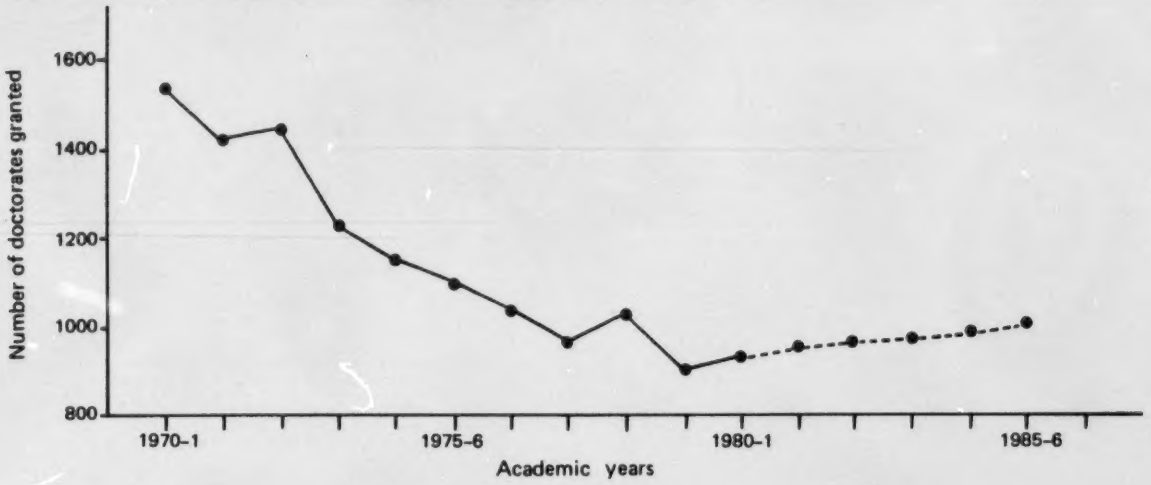
**Institution type indicates the highest physics degree offered: type II = master's degree, type III = doctorate.*

Table IX. Unfilled assistantships for first-year graduate physics students in doctorate-granting departments, September 1981.

Geographic region*	Departments with 0 unfilled ass'tships	1–2	3–5	≥6	No. of dep'ts with unfilled assistantships	Approximate no. of unfilled assistantships	No. of 1st yr. grad. students
New England	17	1	1	–	2	6	262
Mid Atlantic	18	5	5	–	10	25	430
E. N. Central	12	1	4	1	6	25	422
W. N. Central	9	1	1	–	2	5	104
S. Atlantic	14	3	1	1	5	16	247
E. S. Central	1	3	3	1	7	25	50
W. S. Central	9	3	1	1	5	18	185
Mountain	9	1	2	1	4	15	164
Pacific	15	–	1	1	2	11	411
Total					43	146	2275

**See Table IV for explanation of geographic region.*
Note: 24 departments did not answer the question of unfilled assistantships.

FIG. III. Actual and projected number of physics doctorates granted, 1970–1986



The median number of years of graduate study to complete a physics doctorate is five, with a range from three to more than ten years. The high correlation between the first-year graduate students at PhD-granting institutions and the number of doctorates granted five years later is the basis for our projection presented in **Figure III**. During the early 1970's, approximately 45% of those entering graduate students completed their doctorates, but that percentage declined to 42 when examining the class of 1981. A possible explanation for this apparent graduate attrition could be the rapid increase in foreign graduate students who are generally among the doctorate recipients requiring seven or eight years to complete that degree. Hence, by the mid 1980's, the number of physics PhD's conferred is expected to increase, possibly to over 1000 per year.

Degrees granted

Table X presents details on where physics degrees are granted and by what types of institutions. There appear to be three marked regional changes from the previous year: decreases in all graduate degrees granted in New England, as well as doctorates granted in the Pacific region, and a significant increase in bachelor's degrees granted by the four-year colleges in the South Atlantic region.

Though their share is small, master's institutions do contribute to the pool of doctoral candidates by granting master's degrees enroute to a PhD to 10% of those who go on to receive a doctorate. **Table X** shows that in 1980-81, 73 master's degrees of that type were granted.

Table X. Physics degrees by type of institution and geographic region, 1980–81.

	Bachelor's degrees			Master's degrees		Terminal master's degrees		Doctorates
Geographic region*	Institution type** I	II	III	Institution type** II	III	Institution type** II	III	Institution type** III
New England	145	12	390	4	93	0	60	131
Mid. Atlantic	387	45	375	10	132	24	69	207
E. N. Central	283	175	231	21	141	46	94	170
W. N. Central	159	61	99	4	25	15	13	45
S. Atlantic	322	45	254	3	88	10	46	84
E. S. Central	98	61	53	2	12	5	10	14
W. S. Central	147	69	161	7	27	24	21	60
Mountain	68	15	184	1	46	4	33	45
Pacific	192	106	376	21	173	25	78	171
Subtotal	1 801	589	2 123	73	737	153	424	927
				810		577		
Total	4 513			1 387				927

** See Table IV for explanation of geographic region.*

***Institution type indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Table XI. Number of physics degrees granted by sex and minority group status, 1980–81.

Type of degree	Sex	Total no. of degrees	Minority groups								
			Black	Am. Ind.	Puerto Rican	Mex. Am.	Hispanic	Oriental	Asian Ind.	Arab	Total minorities
Bachelor's	Men	4007	106	6	13	10	10	70	13	29	257
	Women	506	22	2	2	3	3	15	0	3	50
	Total	4513	128	8	15	13	13	85	13	32	307
Master's enroute	Men	756	8	2	1	1	4	34	7	6	63
	Women	54	1	0	0	0	0	6	1	0	8
	Total	810	9	2	1	1	4	40	8	6	71
Terminal master's	Men	514	10	1	1	0	8	16	3	7	46
	Women	63	2	0	0	0	0	4	1	0	7
	Total	577	12	1	1	0	8	20	4	7	53
Doctorate	Men	870	9	0	1	1	8	63	36	10	128
	Women	57	2	0	0	0	0	7	4	0	13
	Total	927	11	0	1	1	8	70	40	10	141

A frequent request for information deals with the proportion of women and minorities among physics degree recipients. But these data are relatively difficult to obtain, therefore we extracted degree data from three of our surveys* to produce **Table XI**. There are basically two types of sources: (1) an enumeration of women and minority degree recipients from physics department chairmen, and (2) identification with minority groups by individual graduates. Thus we believe that the number of women as well as the number of minorities at all degree levels represent lower limits. The response rates for each of the eight groups vary considerably, and yet the annual fluctuations in these numbers remain small. However, certain foreign minority groups probably increase much more rapidly than their su.vey responses indicate.

**"Enrollments and Degrees", AIP Pub. No. R-151.19, "1980–81 Survey of Physics and Astronomy Bachelor's Degree Recipients", AIP Pub. No. R-211.13, "1980–81 Graduate Student Survey", AIP Pub. No R-207.14.*

ASTRONOMY

When, in the early 1970's, the Survey of Enrollments and Degrees was expanded to include astronomy data, it was decided to limit that request for information to the "astronomy degree-granting institutions" of which there were approximately 70. **Table XII** presents astronomy enrollments and degrees reported by departments thus defined and totaling 68 in 1981–82. However, there are several major astronomical research centers, (Johns Hopkins and MIT among others), which are not included in the data of **Table XII** because their astronomy research students are granted physics degrees.

Table XII. Trend in astronomy enrollments and degrees, 1975–1982.

Academic year	No. of astronomy degrees granted (July 1 – June 30)				Undergraduate astronomy major enrollment		Graduate astronomy enrollment	
	Bachelor's	Master's enroute	Terminal master's	Doctor's	Juniors	Seniors	Total	1st year
1975–76	172	55	35	93	305	280	780	165
1976–77	184	58	35	96	290	270	790	170
1977–78	177	64	31	93	295	270	803	171
1978–79	165	73	42	90	270	249	710	145
1979–80	165	54	27	106	262	242	698	154
1980–81	156	34	24	82	275	238	686	164
1981–82					252	224	647	142

Table XIII. Astronomy* enrollments 1981-82 and degrees 1980-81 by type of institution.**

		Type I	Type II	Type III	Total
Astronomy departments	Combined	15	4	12	31
	Separate	4	3	30	37
	Total	19	7	42	68
Astronomy degrees	Bachelor's	43	19	95	156
	Master's enroute	-	2	32	34
	Terminal master's	-	6	18	24
	Doctor's	-	-	82	82
Astronomy enrollments	Introd. courses for science majors	280	138	2 370	2 788
	Introd. courses for nonscie. majors	5 599	1 414	33 790	40 803
	Introd. astronomy courses offered in physics departments	-		-	61 267
	Total introductory enrollments				104 858
	Junior astronomy majors	48	29	175	252
	Senior astronomy majors	48	26	150	224
	First-year graduate students	-	11	131	142
	Total graduate enrollment	-	29	618	647

** This survey includes only degree-granting astronomy departments.*
*** "Institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

While the number of astronomy majors as well as graduate students appears to decline, introductory astronomy courses remain a popular choice to fulfill science requirements. Of the one-hundred-thousand students enrolled in such courses, a majority of them take introductory astronomy in physics departments, and fewer than three-thousand students are enrolled in calculus-based courses.

The number of 4-year astronomy departments increased from 17 to 19 in one year, but their introductory astronomy enrollments almost doubled. **Table XIII** divides the 68 astronomy-degree-granting departments into three types by highest degree granted, and presents both enrollments and degrees for each type. The upper portion of **Table XIII** presents a further division of astronomy departments by classifying them as separate or combined. The former refers to departments with a separate chairman, while "combined" are those that are part of the physics department. The data in **Table XIII** include two academic years: degrees for 1980-81 and enrollments for 1981-82.

Additional publications available from the Manpower Statistics Division are:

Graduate Student Survey
Employment Survey
Survey of Physics and Astronomy Bachelor's Degree Recipients